Haimeng Zhao

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Last Updated: October 13, 2025

Education

California Institute of Technology — Pasadena, CA
Ph.D. Student in Physics, Advisor: John Preskill and Hsin-Yuan Huang — 2024–Current

Tsinghua University — Beijing, China
B.S. in Mathematics and Physics with *Honours* and *Summa Cum Laude*, GPA: 3.96/4 — 2020–2024
Thesis: *Quantum Advantage in Machine Learning*, Advisor: Dong-Ling Deng
Valedictorian of the Tsinghua Xuetang Talents Program in Physics

École Polytechnique Fédérale de Lausanne (EPFL) — Lausanne, Switzerland
Exchange student in Physics, GPA: 6/6, Advisor: Giuseppe Carleo — 2022–2023

Experience

Google Quantum AI — Los Angeles, CA
Student Researcher (Mentored by Jarrod R. McClean) — 2025

Institute for Interdisciplinary Information Sciences (IIIS), Tsinghua — Beijing, China
Research Assistant (Mentored by Dong-Ling Deng) — 2023–2024

Institute for Quantum Information and Matter (IQIM), Caltech — Pasadena, CA
Summer Undergraduate Research Fellow (Mentored by John Preskill and Matthias C. Caro) — 2023

Computational Quantum Science Laboratory (CQSL), EPFL — Lausanne, Switzerland
Research Assistant (Mentored by Giuseppe Carleo and Filippo Vicentini) — 2022–2023

Department of Astronomy, Tsinghua — Beijing, China
Research Assistant (Mentored by Wei Zhu) — 2021–2022

Honors and Awards

- Amazon Web Services (AWS) Graduate Fellowship — 2024
- Graduate with the Highest Honours (Honours Degree and 1st Place in Physics), Tsinghua University — 2024
- Graduate with the Highest Distinction (Summa Cum Laude), Tsinghua University — 2024
- Valedictorian of Class 2024, Tsinghua Xuetang Talents Program in Physics — 2024
- Highest Honor for Undergraduate Students, Tsinghua University (清华特等奖学金) — 2023
- Caltech Summer Undergraduate Research Fellowship — 2023
- National Scholarship, The Ministry of Education of China — 2022
- Scholarship of the National Astronomical Observatory of China — 2022
- Lin-bridge Scholarship, Department of Astronomy, Peking University — 2022
- S.-T. Yau College Student Mathematics Contest, Hermann Weyl Silver Medal (2nd Place in Mathematical Physics) — 2022
- S.-T. Yau College Student Mathematics Contest, Team Bronze Medal — 2022
- Dean's Award (1st Place in Physics), Zhili College, Tsinghua University — 2022

- Spark Research Talents Fellowship, Tsinghua University (星火计划 16 期) 2022–2024
- Tsinghua-Xitai Scholarship for Comprehensive Excellence, Tsinghua University 2021
- Tsinghua-UbiQuant Scholarship for Scientific Innovation, Tsinghua University 2021 –2023
- Chi-Sun Yeh Scholarship, Tsinghua Xuetang Talents Program in Physics 2020–2024
- Outstanding Graduate, Shanghai High School 2020
- Best Student Award of Class 2020, Shanghai High School 2020
- S.-T. Yau High School Science Award, Gold Medal (1st Place) in Computer Science 2019
- 19th National Awarding Program for Future Scientists, 1st Place, China Association for Science and Technology 2019
- 36th Chinese Physics Olympiad, Bronze Medal & First Prize in Shanghai, Chinese Physics Society 2019

Academic Service

Journal review: Nature Communications, npj Quantum Information, Quantum, Quantum Machine Intelligence, Quantum Information Processing, IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), Journal of Machine Learning Research (JMLR), IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)
Conference review: QIP, TQC, AQIS, QTML, QCTiP, NeurIPS, ICML

Teaching

Teaching Assistant: Ph/CS 219 Quantum Computation (2025), Ph 220 Quantum Learning Theory (2025) at Caltech

Publications

(* for equal contribution)

[1] **H. Zhao**, Y. Zhang, and J. Preskill, "Learning to Erase Quantum States: Thermodynamic Implications of Quantum Learning Theory", (2025), arXiv:2504.07341.

[2] **H. Zhao** and D.-L. Deng, "Entanglement-induced Provable and Robust Quantum Learning Advantages", npj Quantum Information **11**, 127 (2025).

[3] **H. Zhao***, L. Lewis*, I. Kannan*, Y. Quek, H.-Y. Huang, and M. C. Caro, "Learning Quantum States and Unitaries of Bounded Gate Complexity", PRX Quantum **5**, 040306 (2024), featured on the cover and in the International Year of Quantum Collection.

[4] **H. Zhao**, G. Carleo, and F. Vicentini, "Empirical Sample Complexity of Neural Network Mixed State Reconstruction", Quantum **8**, 1358 (2024).

[5] **H. Zhao**, "Non-IID Quantum Federated Learning with One-shot Communication Complexity", Quantum Machine Intelligence **5**, 3 (2023).

[6] J. Liu, Y. Tang, **H. Zhao**, X. Wang, F. Li, and J. Zhang, "CPS Attack Detection under Limited Local Information in Cyber Security: An Ensemble Multi-Node Multi-Class Classification Approach", ACM Transactions on Sensor Networks **20**, 1–27 (2024).

[7] **H. Zhao** and W. Zhu, "MAGIC: Microlensing Analysis Guided by Intelligent Computation", The Astronomical Journal **164**, 192 (2022).

[8] **H. Zhao** and P. Liao, "CAE-ADMM: Implicit Bitrate Optimization via ADMM-based Pruning in Compressive Autoencoders", (2019), arXiv:1901.07196 [cs.CV].

Talks

1. "Learning to erase quantum states: thermodynamic implications of quantum learning theory", Contributed plenary talk at the 2025 Annual Southwest Quantum Information and Technology (SQuInT) Conference, The University of New Mexico, Oct. 11th, 2025.
2. "Learning to erase quantum states: thermodynamic implications of quantum learning theory", Invited talk at the Quantum Meets Mathematics Seminar, Ohio State University, Sep. 23rd, 2025.
3. "Learning to erase quantum states: thermodynamic implications of quantum learning theory", Invited talk at the Quantum Many-body Seminar, Freie Universität Berlin, Jun. 2nd, 2025.
4. "Learning to erase quantum states: thermodynamic implications of quantum learning theory", Invited talk at the Centre for Quantum Technologies (CQT) CS Seminar, National University of Singapore, May 21st, 2025.
5. "Learning to erase quantum states: thermodynamic implications of quantum learning theory", Invited talk at the Institute for Interdisciplinary Information Sciences (IIIS), Tsinghua University, Apr. 24th, 2025.
6. "Entanglement-induced provable and robust quantum learning advantages", Contributed talk at the APS Global Physics Summit, Anaheim, California, Mar. 17th, 2025.
7. "Learning quantum states and unitaries of bounded gate complexity", Contributed plenary long talk at the 24th Asian Quantum Information Science Conference (AQIS 24), Hokkaido University, Aug. 30th, 2024.
8. "Learning quantum states and unitaries of bounded gate complexity", Invited talk at the Fortnight Seminar Series for Young Scientists, KouShare, Dec. 22nd, 2023.
9. "Learning quantum states and unitaries of bounded gate complexity", Invited talk at the Institute for Advanced Study, Tsinghua University, Dec. 3rd, 2023.
10. "Learning quantum states and unitaries of bounded gate complexity", Invited talk at the Chi-Sun Yeh Student Seminar, Tsinghua University, Dec. 2nd, 2023.
11. "Learning quantum states and unitaries of bounded gate complexity", Invited talk at the Institute for Interdisciplinary Information Sciences (IIIS), Tsinghua University, Dec. 1st, 2023.
12. "Non-IID quantum federated learning with one-shot communication complexity", Contributed talk at Quantum Techniques in Machine Learning (QTML 2023), CERN, Nov. 20th, 2023.
13. "A biased tour in the intersection of physics and machine learning", Invited talk at the Chi-Sun Yeh Student Seminar, Tsinghua University, Mar. 12th, 2023.
14. "Empirical sample complexity of neural network mixed state tomography", Invited talk at the Institute for Interdisciplinary Information Sciences (IIIS), Tsinghua University, Mar. 2nd, 2023.
15. "How can AI do science? A case study on microlensing", Contributed talk ta Zhili College Research Forum, Tsinghua University, Oct. 22nd, 2022.
16. "MAGIC: Microlensing analysis guided by intelligent computation", Contributed talk at the AI for Astronomy conference, National Astronomical Observatory of China, Nov. 25th, 2022.
17. "MAGIC: Microlensing analysis guided by intelligent computation", Invited talk at the Department of Astronomy, Tsinghua University, Oct. 10th, 2022.
18. "MAGIC: Microlensing analysis guided by intelligent computation", Contributed talk at the Student Astronomy Seminar, Department of Astronomy, Peking University, Sep. 23th, 2022.